George Bittlingmayer*

University of Michigan

A Model of Vertical Restriction and Equilibrium in Retailing

One sort of economic behavior that continues to engage the attention of economists is the imposition by some manufacturers of restrictions on their wholesalers and retailers. Why would manufacturers want to impose minimum retail prices, and why would they want to control the locations at which their goods are distributed to consumers? An application of simple economic principles suggests that manufacturers with a monopoly in a product—this could be a monopoly achieved through patents, for example—should charge the profit-maximizing wholesale price and let retailers fend for themselves. And if more stores want to carry the product, so much the better, because this increases the likelihood that consumers will run across it.

A widely accepted explanation for the desire of manufacturers to be able to stipulate resale prices is based on the possibility that manufacturers of branded goods often want retailers to provide some joint service that cannot easily be charged for. The clearest example is sales or promotional effort. The effect of a minimum retail price in these cases is to establish an incentive to provide jointly supplied services that no individual retailer would otherwise provide.

This model of distribution provides a rationale for restrictions placed on retailers by manufacturers. The manufacturer's customers are located uniformly along a road, and retailing operations are subject to increasing returns. Three difficulties arise. First, retailers acting in concert can earn positive profits at the expense of the manufacturer and consumers. Second, costless relocation, free entry, and competition will not result in the store density and retail price favored by the manufacturer. Third, store locations fixed in the short run imply that price cutting would undermine the density of stores preferred by the manufacturer.

While this explanation appears to be appropriate in the case of goods about which consumers are initially ignorant, in many other cases no similar joint product seems to be provided. Why have manufacturers stipulated minimum resale prices on jeans, candies, sport shirts, and numerous other consumer goods that call for little promotional effort at the point of sale?[1]

The model developed in this paper looks at another possible source of such vertical restrictions, namely fixed costs in the provision of retail services. Under otherwise simple demand and cost conditions, the existence of fixed costs can create problems for the manufacturer. Restrictions on retail prices and on related aspects of retailer behavior serve two purposes in such circumstances. First, they prevent retailers from earning profits at the expense of the manufacturer. An organization of retailers, a chain store, for example, can exploit a manufacturer's "monopoly" in a branded good for its own gain and to the disadvantage of the manufacturer. Second, these restrictions allow the manufacturer to influence the density of retail outlets. Costless relocation, free entry, and competitive retail pricing will not lead to the density of outlets and retail prices that maximize manufacturer profits. This is true despite the fact that retail profits are zero under this regime. Since the analysis here indicates that stores are located too close together and charge prices that are too high, *maximum* retail prices provide a way of constraining retailers to the desired combination of retail price and density. Yet another difficulty arises from the fixed store locations that characterize the short run. With fixed locations the possibility exists that stores will compete for higher returns by displacing existing stores. An important aspect of such rivalry is that it can erupt even if stores are making zero profits and have locations and prices that are initially consistent with the manufacturer's aims. For stores satisfying these conditions, a very small decrease in price by any one store (made possible by a small site advantage, say) would force losses nearby and, if the investigator perseveres, drive those at neighboring locations out of business. Although this sort of "discounting" benefits consumers who are near the remaining stores, it hurts the manufacturer and other consumers. The function of minimum retail prices therefore is to prevent price cutting that would undermine the spacing of stores desired by the manufacturer.

---

1. Telser (1960) presents a careful economic analysis of the service explanation. The goods that have been subject to resale price restriction include Levi Strauss jeans, Russell Stover candies, Izod sport shirts, Cuisinart food processors, Midas mufflers, liquor, cosmetics, pharmaceuticals, and books. Any experienced shopper will recall discovering that nearly all the stores selling some particular branded item sold it for exactly the same price.

I. Demand and Cost Conditions

Consider the distribution problem facing the manufacturer of a good. Identical consumers of this good are distributed uniformly along a road, and at each point along the road they demand q units of the good according to the relation $q = a - bp^*$, where p^* is the price they face, a and b are positive constants, and we define the relationship only for $0 \le p^* \le a/b$.

Consumers purchase the good at retail outlets that are located along the road. The cost of these outlets is governed by the equation $c = k + dQ$, where Q is the total quantity of the product sold at a store and k is the fixed avoidable cost and d the marginal cost of operation. There are two reasons for assuming such cost conditions for retailing. First, economies of scale appear to be the best justification we can offer for the fact that the retailers of a good are located some distance apart. Second, any one of several models of inventory holdings suggests that economies arise because of the nature of inventory costs. Since distribution is carried out by having inventories only at certain points, it seems reasonable that these operations exhibit increasing returns. Although the precise relationship of output and costs will not be of the form $c = k + dQ$, the key ingredient, increasing returns, is present in this model.[2]

It will be convenient to make certain simplifying assumptions. First, assume that the product is costless to produce. Cournot's spring water will serve as an example. Also assume that transportation costs from the point of manufacture to the retail outlets are zero. Finally, make the marginal retailing costs, d, equal to zero. It should be clear that we can always consider demand net of these marginal costs and arrive at the same results. Realistic or not, these assumptions make our analysis easier without affecting the results.

Buyers purchase the good at a price p at the store closest to them and

2. In addition to the theoretical results on inventory holdings, certain empirical findings support this view. Cost data presented in a study by the Conference on Price Research of the National Bureau of Economic Research (1941, pp. 256–57) show that operating expense per dollar of sales declines for drug stores and for meat and grocery stores. Although we might argue that there are no economies in retailing because we observe different-sized stores existing side by side, it is not at all clear that large and small stores are perfect substitutes. And once we introduce transportation costs it is of course true that the observed distribution of store sizes, even if these stores provide exactly the same service, says very little about the point at which economics of scale are exhausted. It should of course also be clear from the discussion here that the model considers only the costs of carrying a single item and does not consider the more complex situation that might arise if consumers bought several items in a single trip, as they do in the case of grocery shopping. Interestingly, grocery stores are typically free to price items as they wish, although goods in the same price range carried by five-and-dime stores have frequently been sold at prices that are printed on the container by the manufacturer.

incur shopping costs of ts in order to take home one unit of the good a distance s to where they reside. Since quantity demanded depends on the delivered price, the quantity consumed at any point s will be $q = a - b(p + ts)$ where $p^* = p + ts$. Obviously, the efficient assignment of a given number of stores to the road will call for each store to be located at the midpoint of the interval which it serves. These intervals will also be equal for all stores. Exceptions to this rule will occur if the road is not infinitely long or if it is not an integer multiple of a certain length. These exceptions are not the prime concern, however, and they will be ignored.

How should the shopping costs be interpreted? In this model they can be thought of as the costs consumers incur in traveling to the nearest store, buying the good, and returning home. This seems to be all that is required to justify the assumption of significant shopping costs for the consumer and negligible transportation costs for the retailer who buys his goods in bulk at the factory gate. Shopping costs are a substantial fraction of the full cost of most consumer items. A broader interpretation, however, is that these costs allow us to represent situations in which the likelihood that a consumer will buy a particular branded good increases as the density of retail outlets increases.

Adopt the convention for a typical interval that the store is located at the point zero and that the interval it serves is $[-s, s]$. If this store charges p per unit and serves the interval $[-s, s]$, how much will it sell? Define this amount as $Q(p, s)$, so that we have

$$
\begin{aligned}
Q(p, s) &= 2 \int_0^s [a - b(p + t\sigma)] \, d\sigma \\
&= 2s(a - bp) - bts^2.
\end{aligned} \tag{1}
$$

One implication of this relationship is that if we expand the territory of a store (while maintaining a fixed price), a point will be reached at which the quantity purchased reaches a maximum. Since we have

$$
\frac{\partial Q}{\partial s} = 2(a - bp) - 2bts, \tag{2}
$$

this occurs when $a = b(p + ts)$ or when demand is choked off because of the high delivered price. Note also that since $p > 0$ we restrict our attention to intervals for which $s < a/bt$.

Suppose our manufacturer operates only one retail outlet on the road. What price would he charge and how far would his territory extend? From a practical standpoint this is an uninteresting situation, but it will serve to establish some analytical points and illustrate what may seem to be the opportunities facing a single retailer. Since profit is

simply total revenue less total cost, we can define it as quantity sold times the per unit price, less fixed costs:

$$\pi = Q(p, s) \, p - k$$

$$= [2s(a - bp) - bts^2] \, p - k. \tag{3}$$

Regardless of the price charged, we know that a single outlet will serve buyers along the road until the point is reached where the amount demanded vanishes. Set (2) equal to zero so that we obtain $s = (a - bp)/bt$ and substitute this into (3). Consequently we have

$$\pi = \frac{(a - bp)^2}{bt} \, p - k \tag{4}$$

and

$$\frac{\partial \pi}{\partial p} = \frac{(a - 3bp) \, (a - bp)}{bt}. \tag{5}$$

Obviously (5) will be zero either for $p = a/3b$ or $p = a/b$. Since (4) is concave for $0 < p < 2a/3b$, the first point represents a maximum. (The second point, $p = a/b$, is a minimum that occurs when quantity and revenue are zero. For higher prices we would get negative quantities and negative distances but for the fact that we have defined our demand curve only for $0 \leqslant p \leqslant a/b$). The optimal interval for this price will reach out to $s = 2a/3bt$ in each direction, and the interval will have a length equal to $4a/3bt$.

It is useful to anticipate some results at this point. First, the possibility that we can use more stores will in general require shorter intervals since we have implicitly assumed that extra stores are infinitely costly. It is also apparent that independent retailers would prefer not to have competition at their borders but that they will usually be in a position to impose externalities on each other through invasions of territory. Note that we also have a break-even condition for the value of k. For nontrivial solutions to the maximization problem we have $p = a/3b$ and $s = 2a/3bt$. Substitute these values into (3) and impose the condition that $\pi > 0$. It then turns out that we must have

$$k < \frac{4a^3}{27b^2t} \tag{6}$$

in order for profits to be greater than zero.

Finally, consider the case in which a manufacturer designates a retailer who may operate only one store. For a given wholesale price w the profit opportunities facing this retailer are defined by

$$\pi' = [2s(a - bp) - bts^2](p - w) - k.$$

In general the profit-maximizing solution of the retailer will call for a higher price and a shorter interval. For example, the optimal distance to the border will be

$$\frac{2a}{3bt} - \frac{2w}{3t};$$

that is, the distance is a linear function of w, and it is shorter than for the integrated manufacturer/retailer operating the same store. This illustrates one source of difficulty for the manufacturer, in particular that the retailer's incentives are inconsistent with what the manufacturer wants or even with what would maximize their joint profits. It is the analog in a spatial context of the result in a more familiar setting that a monopolist buying from a monopolist will raise the price above what it would be for a single, vertically integrated monopolist. In that case efficient (single-price) monopoly calls for vertical integration or some sort of vertical restraint. Essentially similar results emerge for the spatial market.

II.   Vertically Integrated Distribution

The case just analyzed in which a manufacturer has only a single store is most emphatically not the problem a manufacturer faces. One possible course of action will call for the manufacturer to run his own retail organization composed of many stores, which some manufacturers do. What characterizes the solution to this retailing problem? In our case we see that the manufacturer will be concerned with maximizing profit *per unit distance*.[3] Consequently, in place of (3), the manufacturer will look at

$$\pi/s = [2(a - bp) - bts]\, p - k/s, \tag{7}$$

and his aim will be to pick an interval $[-s,\ s]$ and a price p that maximizes the value of this function. First-order conditions for (7) are[4]

---

3. Since the length of the line is fixed, maximizing profits per unit distance implies the same solution as maximizing profits over the whole length of the line by picking the optimal number of equidistant stores.

4. The second-order conditions are straightforward:

$$\frac{\partial^2(\pi/s)}{\partial s^2} = -2k/s^3 < 0$$

and

$$\frac{\partial^2(\pi/s)}{\partial p^2} = -4b < 0.$$

We also have $\partial^2(\pi/s)/\partial s \partial p = -bt < 0$. By the second-order test for an extremum, points

$$\frac{\partial(\pi/s)}{\partial s} = -pbt + k/s^2 = 0 \tag{8}$$

and

$$\frac{\partial(\pi/s)}{\partial p} = 2a - 4bp - bts = 0. \tag{9}$$

The first condition says that the savings that come from spreading the fixed costs k over a greater distance should just equal losses of revenue per unit distance that come with greater distance. The second sets marginal revenue over the internal equal to zero. It sets the gain in marginal revenue coming from consumers located directly at the store equal to the loss occurring at the margin over the length of the interval. Expressed as functions of p, these two conditions are

$$p = k/bts^2 \tag{8'}$$

and

$$p = \frac{1}{2}\frac{a}{b} - \frac{1}{4}ts. \tag{9'}$$

The solid lines in figure 1 represent these two equations. In general the optimal policy from the manufacturer's point of view calls for each identical store to serve a smaller market and to charge a higher price than if he were operating only a single store by himself. The optimal solution will lie among (9') and move leftwards and up as the fixed retailing costs decrease.

III. Coordinated Distribution Outlets

In many circumstances it is impractical, which is to say costly, for manufacturers to manage their own retail outlets. Suppose now that the manufacturer simply sets a retail price w and lets anyone who would like to do so set up a store at one or more locations. Are there profit opportunities for retailers under such a regime? It turns out that there are. What is more, these profits are won partially at the manufac-

---

where both partial derivatives are zero and the second partials are negative represent a maximum if

$$\frac{\partial^2(\pi/s)}{\partial s^2} \cdot \frac{\partial^2(\pi/s)}{\partial p^2} > \left(\frac{\partial^2(\pi/s)}{\partial s \partial p}\right)^2,$$

which is our case requires

$$s < 3\sqrt{\frac{8k}{bt^2}}.$$

Call the interval for which this holds [0, s']. This is a sufficient condition for a maximum. It is easy to show, however, that of the two solutions implied by (8) and (9), only one falls in this interval, while the other is a saddle point.
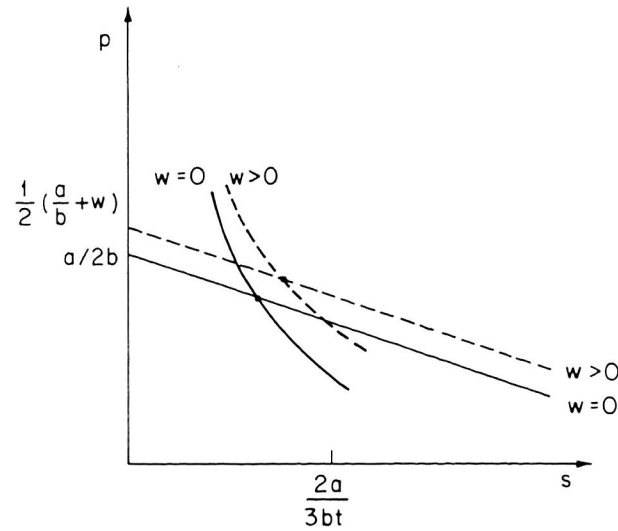
$$\text{FIG. 1}$$

turer's expense. To investigate these points, the initial focus will be on the maximum joint returns available to retailers as a group (the maximum return to retailers per unit distance). This will answer the question of what an exclusive but otherwise unrestricted retail organization would do. Later we will explore the question of how closely a set of retail outlets can approximate this solution without being awarded the exclusive franchise but simply by placing stores at the proper locations.

Our retail organization is concerned with maximizing returns per unit distance. Consequently we have

$$\pi/s = [2(a - bp) - bts] (p - w) - k/s, \tag{10}$$

which implies the following first-order conditions:

$$- bt (p - w) + k/s^2 = 0 \tag{11}$$

and

$$[2(a - bp) - bts] + (p - w)(- 2b) = 0, \tag{12}$$

since the aim is to pick the values of p and s that maximize π/s. These are more enlightening if rearranged as analogs to (8′) and (9′):

$$p = \frac{k}{bts^2} + w \tag{11′}$$

and

$$p = \frac{1}{2}\frac{a}{b} - \frac{1}{4} ts + \frac{1}{2}w. \tag{12′}$$

These equations are shown in figure 1 for two cases, w equal to zero and w equal to some positive value. In general, of course, the solution

to this set of equations implies a different price and store territory than we found for the vertically integrated manufacturer/retailer, except in the case where w equals zero.[5] For a large enough k it is clear that a retail organization that takes up locations and that charges prices as determined by these equations will also prevent any would-be entrants from making profits so long as it holds to this policy. Consequently, the strategy that maximizes retailing returns per unit distance is also invulnerable except to manufacturer action.

It is possible to gain a better understanding of the general conditions under which a retail organization can earn positive profits. First, examine the conditions under which $\pi = [2s(a - bp) - bts^2](p - w) - k$ is equal to zero. Note first that since we are concerned with the possibilities available to retailers for arbitrary values of w, and since raising w is equivalent to lowering the value of a, we can set $w = 0$ without affecting the analysis. An explicit solution to this equation is still tedious, however, because it involves quadratic terms. But by means of the quadratic formula and the implicit-function rule we can establish the following. First, expressed as a function of p, the solution is $p = a/2b - ts/4$ plus or minus a complicated term involving the other parameters and k. Second, it turns out that $dp/ds = 0$ where the function intersects $p = a/b - ts$, and $dp/ds = \infty$ where it intersects $p = a/2b - ts/4$. These results are represented in figure 2. Obviously, a lower k will imply a greater range for p and s over which profits are nonnegative.

How do we characterize the opportunities available to would-be entrants? The best possible location is halfway between the existing stores. For any given price p and distance to the boarder s for the existing outlets we also have some optimal price and (implied) distance to the border, call them $\bar{p}$ and $\bar{s}$, for entrants. The boundaries between existing stores and entrants is given by the solution to

$$\bar{p} + t\bar{s} = p + t(s - \bar{s}). \tag{13}$$

This in turn implies that entrants will attempt to choose values of $\bar{p}$ (and by implication $\bar{s}$) that maximizes $\bar{\pi} = [2\bar{s}(a - b\bar{p}) - bt\bar{s}^2]\bar{p} - k$, subject to (13). Note that (13) can be rewritten as

$$\bar{s} = \frac{p - \bar{p}}{2t} + \frac{s}{2}$$

and that $\partial\bar{s}/\partial\bar{p} = -1/2t$. Consequently, we can derive the first-order condition simply for $\partial\bar{\pi}/\partial\bar{p}$ instead of working out the results of a con-

5. Clearly, the integrated retailer/manufacturer and the exclusive retail chain facing a wholesale price of zero would adopt the same retail price and the same intervals. This explains why the solid lines in fig. 1 describe the first-order conditions for both problems.

strained maximization problem. Starting out with

$$\bar{\pi} = 2\bar{s}(a - b\bar{p} - \frac{1}{2} bt\bar{s}) \bar{p} - k,$$

we have

$$\frac{\partial \bar{\pi}}{\partial \bar{p}} = 2\frac{\partial \bar{s}}{\partial p} (a - b\bar{p} - \frac{1}{2}bt\bar{s})\bar{p} + 2\bar{s}(a - b\bar{p} - \frac{1}{2}bt\bar{s})$$
$$+ 2\bar{s}\bar{p} (- b - \frac{1}{2}bt \frac{\partial \bar{s}}{\partial \bar{p}});$$

and since $\partial \bar{s}/\partial \bar{p} = -1/2t$, we obtain, after some rearrangement,

$$\bar{p}^2 \left(\frac{b}{t}\right) - \bar{p}\left(\frac{a}{t} + 3\bar{s}b\right) + 2\bar{s}a - bt\bar{s}^2 = 0.$$

By the implicit function rule,

$$\frac{\partial \bar{p}}{\partial \bar{s}} = (- 3b\bar{p} + 2a - 2bt\bar{s})\bigg/ \left(\frac{3\bar{p}b}{t} - \frac{a}{t} - 3\bar{s}b\right),$$

which implies that a maximum is reached when $\bar{p} = 2a/3b - 2t\bar{s}/3$ is equal to $\bar{p} = a/2b - t\bar{s}/4$, or where $\bar{s} = 6a/15bt$. These results are also displayed in figure 2. The locus of maximization points (shown by the dotted line) is related to the equilibrium points in what has come to be called Hotelling-Smithies competition, in which each firm maximizes profits taking the locations and prices of its neighbors as given (see the analysis by Capozza and Van Order [1978]). Instead of representing an
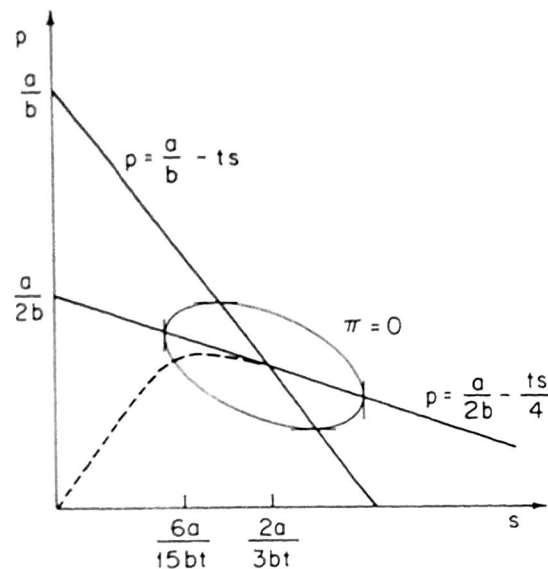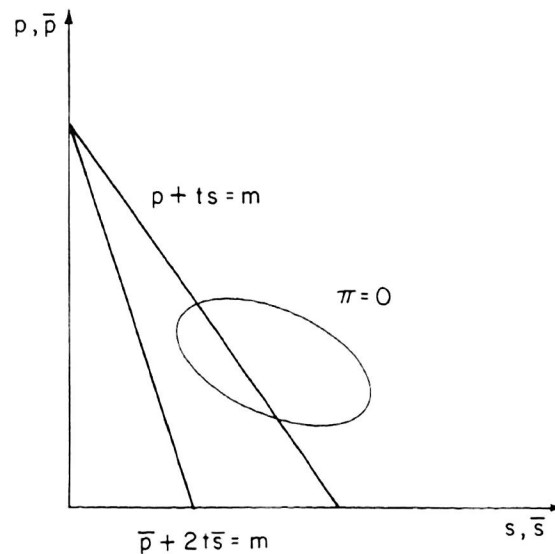

Fig. 2

FIG. 3

equilibrium, however, we interpret the locus of points as the best possible response of entrants to an existing retail monopoly, conditional on the retail monopoly maximizing profits without the threat of entry in mind. Intuition in this case does suggest, however, that it will always be possible for the existing retail organization to adopt prices and locations that will successfully thwart entry. This may entail some sacrifice in profits, but at a low enough price and a short enough store territory, potential entrants will have to suffer losses and be discouraged from entering.

This can be shown with the aid of figure 3. The loop represents for a given value of k the locus of zero profits for either existing firms or entrants. We also have the relationship between the possible combinations of and border distances of existing firms on the one hand and the same variables for new entrants on the other. This is given by $p + ts = \bar{p} + 2t\bar{s}$. The existing firm can pick a value for the left-hand side, say m, and this determines the overall value of the right-hand side. Diagrammatically, it means that combinations of p and s can always be chosen that result in positive profits inside $\pi = 0$, while at the same time implying losses for the would-be entrants. The practical implication of this analysis is that it provides a possible explanation for the refusal of some manufacturers to allow chain stores to handle their products. By choosing the appropriate prices and distances between stores, and making the establishment of competing stores unprofitable, a chain store could appropriate some of the profit that would otherwise go to the manufacture. Again, "distance" should be understood as economic distance, so that transportation costs can be used to represent search and shopping costs.

IV.   Competitive Retailers

Obviously, the manufacturer will not be happy if his distribution is
carried on by a retail monopoly since, with the same retail price and a
higher density of stores, his sales at the constant wholesale price will
be increased. One course of action calls for him to let only those
merchants handle his product who behave "competitively." This is,
however, also not the ideal situation. A verbal summary of the results
in this section suggests why this is so. A competitive equilibrium in
spatial competition is characterized by two conditions: profits are zero
and marginal costs equal marginal revenue. It turns out, however, that
the nature of the behavioral assumption chosen will govern the form of
each retailer's demand curve and hence each retailer's marginal reve-
nue. So, for example, Löschian competition implies relatively steep
demand curves, because each retailer imagines himself to be operating
in an exclusive market area with no competition at the borders. In
contrast, Hotelling-Smithies competition implies flatter demand
curves, because each retailer believes that his neighbors' prices and
locations are fixed. An even more extreme assumption results in still
flatter demand curves, because retailers imagine the price they face at
their boundaries to be fixed. Consequently, while there is only one
optimum combination of retail price and interval length, there are a
number of combinations implied by the various solution concepts and
no clear consensus about which should be preferred. Fortunately for
the analysis here, the range of price-interval combinations implied by
these solution concepts does not include the solution preferred by the
manufacturer. So, although I argue for the use of the concept that
brings about the lowest prices and longest intervals plausible under
monopolistic competition, the resulting prices are still too high and
intervals too short to please the manufacturer.

The easiest way to explore these issues is with the aid of a diagram.
Figure 4 presents the locus of points for a particular set of parameter
values for which profits are equal to zero. If stores can be moved easily
(if they are on roller-skates) and collusion among outlets is not per-
mitted, then entry will take place until profits are zero, that is, until
store locations and retail prices conform to one of the combinations in
the southwest segments of $\pi = 0$. The second condition will call for
changes in price at a particular store to result in negative profits. The
assumption that stores can be moved costlessly together with the as-
sumption of free entry and independent pricing implies that the price a
store faces at its border is fixed. Call this price p^0. Consequently, the
distance to the border for any price p is found as the solution to $p + ts
= p^0$. More important, this relation implies that $dp/ds = -t$. In terms
of figure 4, it has the interpretation that the monopolistic competition
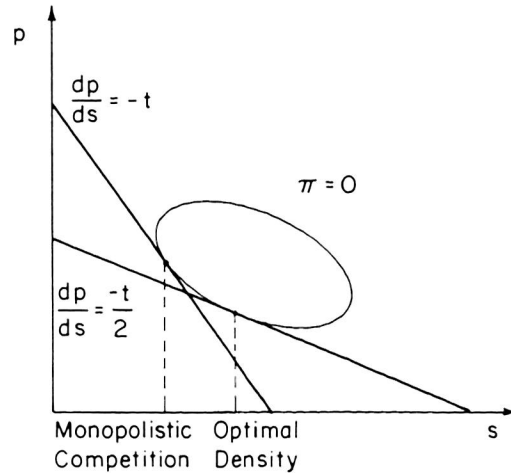equilibrium occurs where $\pi = 0$ has a slope of $-t$. Under these as-

FIG. 4

sumptions, profits are maximized, but they are also equal to zero. This is what Capozza and Van Order (1978) call Greenhut-Ohta competition.

At least two other solution concepts are also a possibility, but since they imply an even larger discrepancy between the competitive solution and what the manufacturer wants, and since they have been developed elsewhere, I will provide only a brief statement of the results. Hotelling-Smithies competition, in which firms believe that store locations are fixed and that their competitors do not respond with price changes, implies $dp/ds = -2t$, which together with a zero profits constraint, calls for even shorter intervals and higher prices. Löschian competition, an extreme case, implies the shortest intervals compatible with retailers breaking even.[6] Although it carries no consequences for what follows, I will express my preference for the Greenhut-Ohta alternative, because it does not imply that firms believe locations to be fixed when in fact entry and relocation are a crucial part of long-run equilibrium. It more nearly captures the spirit of "price taking" because an individual firm, very small relative to the market, that decides to raise or lower its price will only have the effect of moving its neighbors closer or farther away as it raises or lowers its prices. Other firms, even the immediate neighbors, will not suffer or gain in any way. The movement of firms along the line will simply be stimulated by small changes in price that are communicated down an endless chain. Granted, there is an inconsistency for lines of finite length, but this should be no more troubling than similar inconsistencies in the standard competitive model.

These are the competitive solutions. What is the optimal policy for

6. The isomorphism between these three concepts and the competitive, Cournot, and monopoly solutions to the standard textbook problem is worth noting.

the manufacturer? The total quantity sold by a store is $Q = 2s(a - bp) - bts^2$, which implies that quantity per unit distance is $T \equiv Q/s = 2(a - bp) - bts$. The objective of a manufacturer, for any given wholesale price, is to maximize this quantity. Rearranging terms, we obtain

$$p = \frac{a}{b} - \frac{T}{2b} - \frac{1}{2}\,ts$$

as the line describing, for any given quantity per unit distance, the combinations of p and s that yield that quantity per unit distance. The manufacturer's problem can be thought of as one of constrained maximization: maximize T subject to $\pi \geq 0$. In terms of figure 4 it means that the manufacturer would call for longer intervals and lower prices than implied by the most favorable form of monopolistic competition and, a fortiori, by Hotelling-Smithies or Löschian competition.

It can be verified that this maximization problem results in the same retail price and interval lengths as the integrated manufacturer/retailer in Section II would prefer. Set up the following Lagrangian problem: Pick values of p, s, and w to maximize manufacturer revenues per unit distance subject to retailers just breaking even. Formally,

$$L = [2(a - bp) - bts]w + \lambda\,\{[2(a - bp) - bts]\,(p - w) - k/s\}.$$

Two of the resulting first-order conditions are the same as (8) and (9), giving the solution to the vertically integrated maximization problem, and the remaining two set $\lambda = 1$ (the value of an extra dollar of revenue) and establish w conditional on the values of p and s (by means of the break-even constraint).

V.   Restrictions on Retailers and the Short Run

It becomes clear from the foregoing discussion that there is no automatic tendency for systems of retailing to emerge that serve the manufacturer's purpose. Retail operations that are run collusively have the effect of reducing the manufacturer's profit, as does competitive retailing with free entry and easy relocation, since both result in less sold per unit distance for any given wholesale price.

Two possible solutions to the manufacturer's problem as stated so far suggest themselves. The manufacturer might try to achieve the optimal retail price and density of stores by specifying *maximum* retail prices or by specifying a limit to the number of stores. A limit to the number of stores has the implication, however, that under any of the three plausible behavioral assumptions discussed, prices would rise. Since $dp/ds \leq -t$ under these assumptions, firms will imagine, correctly as it turns out, that their profits will increase with increases in price. An upper limit on prices, however, would prevent this behavior. Surprisingly, perhaps, this analysis suggests that manufacturers should

be interested in imposing maximum, and not minimum, retail prices. There are in fact instances where just such a stipulation has been made.[7]

Until this point the analysis has been about the long run. Stores relocate in response to price changes and move costlessly. But it seems sensible to look at what happens when store locations are fixed. This is an extreme case of costly relocation, but it provides some discipline to the problem. The familiar model of competitive equilibrium makes the same distinction: The number of firms and firm capacities are fixed in the short run but variable in the long run.

The difficulty that arises at this point is general to all sets of fixed locations and prices that result in zero profits. As already mentioned, there are obvious evils that come with fixed locations and the apparent temptation to raise prices, since this permits the retailer to exploit the manufacturer's monopoly to his own benefit. Fixing locations makes it reasonable to suppose, in fact, that prices will be increased according the Löschian assumption since store territories are fixed. But with a specified maximum retail price this problem would not exist. A new danger, however, arises from the possibility of retailers lowering prices. Before, under the Greenhut-Ohta assumption that was used to characterize the long run, price decreases resulted in the movement of neighboring firms so that the price at the border stayed constant. Now, however, a lower retail price must imply that a firm that lowers prices will incur losses and force its neighbors to incur losses as well. Within the confines of the formal model the outcome of this sort of struggle is indeterminate, since firms initially have equal retail prices, equal costs, and equal territories. In practice, however, any slight advantage at one store (such as greater demand or lower costs) will allow it to win a battle with its neighbors. More important, the surviving firm will have greater profits, even if it observes the manufacturer's stipulated maximum price, because it gains the extra demand forfeited by its former competitors. To prevent this, the manufacturer can institute and enforce a system of minimum retail prices. This keeps would-be discounters from driving their competitors out of business and from disrupting the optimal density of retail outlets.

VI. Concluding Comments

The argument advanced in this paper has not been incorporated in the economic literature on vertical restrictions and resale price mainte-

---

7. For example, *Kiefer-Stewart v. Seagram & Sons* (1951) and *Albrecht v. Herald Co.* (1968). Clearly, manufacturers can often establish what amounts to a maximum price by printing a price on the package, suggesting to consumers that some other store may carry the item at that price even if this one marked it up.

nance, although certain similarities to work on other topics should be noted.[8] The formal model has close relatives in the literature on spatial competition, and the analysis is related also to the theory of economic regulation, as a comparison of the model here with that due to Telser (1969) will reveal. The common element is of course increasing returns, and indeed the model here suggests that vertical integration and vertical restraints can be viewed as the private regulation of an economic organization that does not, or cannot, achieve efficient competitive outcomes.[9]

There are many ways in which the simple structure of this model could fruitfully be elaborated. Clearly, an explicit treatment of inventories and consumer search behavior would be a desirable improvement. The analysis of inventories and equilibrium due to Gould (1978) suggests ways of doing this. A more complete model could probably tell us more about the economics of vertical restrictions. For example, it might explain why such restrictions often include minimum limits on prices but only rarely specify maximum prices. It would also be desirable to treat the transition from short to long run with a better-formulated dynamic mechanism.

A more detailed look at consumer search may illuminate the relationship between branded goods and the reputation of retail outlets that carry them. An intuitively plausible, but undeveloped, explanation for resale price maintenance in the case of some goods is that certain manufacturers want only prestige stores with high overhead to carry their goods. This is related to the service argument, since manufacturers want some service provided that cannot be charged for directly. This line of thought is intriguing, but has yet to be developed in the context of an explanation that assumes rational self-interest, including some optimal degree of ignorance, on the part of firms and consumers. In contrast to the service argument, it is not clear what is being provided by the high-priced retailer, or why the existence of discounters carrying the same good would prove to be against the interest of the manufacturer.

Some comments are also in order concerning the question of monopoly, represented here as downward-sloping demand for the manufacturer's product. Clearly there are many areas in which this occurs, publishing being a case in point. Yet we attach no overriding welfare significance to the fact that the publisher of a best-seller has a monopoly. This is generally justified on the grounds that the author and pub-

8. Since writing the first draft of this paper I have discovered that G. F. Mathewson and R. A. Winter (1982) have also employed a model of spatial competition to analyze vertical restrictions on retailers. Although I think the spirit of their analysis is similar to mine, the two papers diverge at several points.

9. The effect of minimum resale prices on the number of retail outlets has been long noted in the institutional literature. See, e.g., Kuipers (1950, pp. 107–16).

lisher must be guaranteed some way of recouping their costs, even if the arrangement violates the marginal conditions for an optimum.

The suspicion that downward-sloping demand for the product and fixed costs are crucial ingredients is confirmed by the early history of the sugar industry. The American Sugar Refining Company and its predecessor the Sugar Trust maintained a wholesale price agreement with the Wholesale Grocers' Association beginning in 1889. "So keen was the competition between wholesale grocers that sugar was regularly being sold at cost or below; and, in order to restore a more reasonable condition of affairs, they sought and obtained from the refining company an agreement under which sugar was bought and sold by wholesalers at a uniform price per pound, with a rebate to all who maintained that price" (Haney 1913, p. 159). While it might be argued that the manufacturer, who had a very large market share at this time, was the cat's-paw for a wholesalers' cartel, another sensible explanation is that a stable distribution network served the manufacturer's interest. Otherwise, one would have to explain why a powerful manufacturer acquiesced to a scheme that raised distribution costs. Interestingly, the theory here also suggests that the retailing problems that arise when there are fixed costs in retailing should be just as formidable for a perfectly competitive industry producing a homogeneous good. This provides an explanation for joint efforts on the part of manufacturers to impose resale prices on the industry's products.[10]

The practical insights of the formal model are probably best elucidated by taking the manufacturer's perspective. For example, a little reflection about the distribution problem of a publisher suggests that for a given wholesale price, profits are greater if more bookstores carry his books and if the retail price is lowered. These two desiderata are inversely related, however, and the purpose of a margin set by the publisher is to induce more outlets to carry his publications. If other bookstores are permitted to carry the book and if average inventory costs decrease with sales, retailing will not result in supracompetitive returns. Moreover, if the manufacturer sets the correct resale price, retailing will be carried out efficiently. It may be useful to consider the

10. A study of resale price maintenance in the United Kingdom observes that "it is commonly assumed that resale price maintenance technique can only apply to the trade in branded products. . . . In fact, however, the prerequisite . . . is rather that the product concerned should be sufficiently homogeneous" (Kuipers 1950, p. 12). The author cites motor vehicles and dental goods as items for which manufacturers agreed on a system of minimum *retail* prices (p. 63). In the grocery trade, resale prices on at least 66 categories of goods, including baking powder, cornflour, and vinegar, were protected through the efforts of the Grocery Proprietary Articles Council, an organization of manufacturers (pp. 144–45). It is not clear from the author's discussion whether identical prices were charged for, say, two brands of baking powder, but it seems odd in any case that they would endorse each other's attempt to maintain retail prices, quite aside from whether the two had a cartel at the wholesale level.

alternative. What would happen and whose interests would be served if the publisher of a best-seller set only a wholesale price and let bookstores price the book as they wished? It is not far-fetched to imagine that discount mail-order sales of books would soon account for a large fraction of book sales and that the function that bookstores have of lowering consumer search costs would no longer be served, because such stores would no longer be profitable. It also seems safe to say that publishing is in no fundamental economic sense unique, either in its cost conditions or its marketing problem.[11]

Now it has to be granted that vertical restrictions, especially resale price maintenance, are not as widely used as the model might suggest. In part this has to be attributed to the hostile legal environment.[12] Resale price maintenance has in the past been widely used in the United States, the United Kingdom, and many European countries. However, seen in the absence of legal restrictions, one would not expect it to be used universally for a number of reasons. To illustrate, the use of such a mechanism to enforce efficient distribution is not costless. Manufacturers incur monitoring and enforcement costs, with enforcement carried out largely by terminating dealers and disrupting the retailing organization. In such cases the losses that come from an inefficient retail distribution may be outweighed by the gains that come from not having to keep track of hundreds or thousands of retailers and occasionally terminating them. Consequently, one expects vertical restrictions more often where the ideal number of retail outlets is less and where the cost of shifting business from one outlet to another is not great. Another variety of loss occurs because retailers lose the discretion to respond to local circumstances. If retail prices are fixed, retailers cannot respond to local seasonal fluctuations or practice the sort of intertemporal price discrimination that special sales seem to imply.

Other implications follow from the role played by transportation

11. Not all the copies of a book are sold at the same price, of course, and even best-sellers are discounted (slightly) by book clubs. As is well known, publishers themselves practice intertemporal price discrimination through paperback sales. The crucial question, however, is why book prices are not determined by the bookseller for the bulk of new sales. This is particularly true for academic books, for example. U. af Trolle (Yamey 1966, p. 105) notes that resale price maintenance made its first appearance in Europe in publishing. Yamey (1966, p. 252) summarizes the early history of the practice for publishing in the United Kingdom. An intriguing aspect of this history is that it was abandoned in 1852 because of public opinion and revived in the 1890s, with Marshall's *Principles of Economics* among the first books to be marketed this way again.

12. It is not quite true that resale price maintenance is now illegal, although it is strongly discouraged. A great deal seems to hinge on whether the price is established through an agreement or mere "jawboning." Although it is generally acknowledged to be an unsettled area of the law, where manufacturers are advised to tread delicately ("When the occasion arises, legal advice should be obtained," counsels Hancock [1979, chap. 11, p. 15]), as a practical matter resale price maintenance has recently been used for a number of goods (see Taylor 1980).

costs. These can be thought of not merely as the literal costs of traveling to the nearest store and returning home but also as the diminished likelihood of purchase that comes with a lower density of stores carrying an item. Since as transportation costs decrease the model approaches the standard competitive case and the losses from unrestricted competition and entry diminish, one would expect the practice to be used more frequently, either where actual transportation costs are large or where the product is new or the class of potential buyers is constantly turning over. Consequently, resale price maintenance was used for ball point pens and food processors when these were first introduced, but is still used for a well-established brand of candy that is often made a gift, presumably by husbands and boyfriends who were at their wits' ends about what to buy for that special occasion.

Yet another important influence limiting the use of vertical restrictions lies outside the formal model. Largely as a result of higher incomes and the development of self-service stores, the typical consumer buys many items during a single shopping expedition. Competition between grocery stores is carried out by taking into account the characteristics of consumers and appealing to a particular group with favorable prices for particular bundles of goods. Restrictions on resale prices would prevent this sort of competition, and retailers would turn to manufacturers without this restriction. It is not surprising to discover, for example, that many of the items that are commonly priced independently by supermarkets today were sold under resale price maintenance when it was not unusual for housewives to visit three or four different stores to do their grocery shopping.[13] Another way of viewing the issue is to say that for most grocery items an individual retailer will not be deterred from carrying a good if it is discounted nearby, since his usual clientele will not bother to switch stores, even for the discounted item.

References

Albrecht v. Herald Co., 390 U.S. 145 (1968).

Capozza, Dennis R. and Van Order, Robert. 1977. Pricing under spatial competition and spatial monopoly. *Econometrica* 45 (September): 1329–38.

Conference on Price Research, Committee on Price Determination. 1943. *Cost Behavior and Price Policy*. New York: National Bureau of Economic Research.

Gould, John P. 1978. Inventories and stochastic demand: Equilibrium models of the firm and industry. *Journal of Business* 51 (January): 1–41.

Hancock, William A. 1979. *Executive's Guide to Business Law*. New York: McGraw-Hill.

Haney, Lewis H. 1913. *Business Organization and Combination*. New York: Macmillan.

Kiefer-Stewart Co. v. Joseph E. Seagram & Sons, Inc. 340 U.S. 211 (1951).

13. The Kellog Toasted Corn Flakes Company, e.g., used to sell its products only to retailers who agreed to maintain a minimum price (see Haney 1913, p. 158).

Kuipers, John Dennis. 1950. *Resale Price Maintenance in Great Britain.* Wageningen: Vada.

Mathewson, G. F., and Winter, R. A. 1982. Vertical integration by contractual restraints in spatial markets. Working Paper no. 8205. Toronto: University of Toronto, Institute for Policy Analysis.

Taylor, Robert E. 1980. Litvack gets attention of business with novel antitrust prosecution. *Wall Street Journal,* October 31.

Telser, Lester G. 1960. Why should manufacturers want fair trade? *Journal of Law and Economics* 3 (October): 86–105.

Telser, Lester, G. 1969. On the regulation of industry: A note. *Journal of Political Economy* 77 (November): 937–52.

Yamey, Basil S. 1966. *Resale Price Maintenance.* Chicago: Aldine.